



Written Testimony of Liza Tobin
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in the Critical and Emerging Technologies of the 21st Century”
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Chairman Gallagher, Ranking Member Krishnamoorthi, Members of the Committee, thank you for the opportunity to provide you with my testimony.

Here, I will address the requirements for U.S. leadership in technology innovation in light of the Chinese Communist Party’s (CCP) drive for techno-economic dominance. Systemic rivalry between the United States and our democratic allies and partners, and the People’s Republic of China (PRC) under the leadership of the CCP is a defining feature of international politics today. The CCP has for decades recognized – and the United States has only recently come to acknowledge – this rivalry and the central role that technology plays in it. Technologies, such as artificial intelligence (AI) and advanced communications, are at the heart of the competition. These technologies will drive the global economy in the years to come, and they can be used to promote openness and freedom or surveillance and control. The United States and our allies and partners must act urgently to organize and prevail in this contest. The next several years are critical to cementing, extending, or even regaining our technological lead.¹ If we fail to do so, we risk losing open markets and free societies to autocratic rule.

My testimony is divided into two parts: first, my perspective on the challenge we face, and second, my observations on what is missing from the current United States “promote and protect” policy framework, as well as initial ideas on how to fill this gap.

I. The Challenge: The CCP’s Drive for Techno-Economic Dominance

Beijing is committed to achieving preeminence across a broad range of strategic technologies. Its strategy is not new, nor is it a response to U.S. policies. Beijing has a track record of executing well-resourced industrial policies that have produced results. What is new is a growing awareness in the United States of the CCP’s ambitions and increasing capabilities to achieve them.

¹ On the urgency of the challenge, see [Mid-Decade Challenges to National Competitiveness](#), Special Competitive Studies Project at 26-27 (2022). Since that report was published, dramatic developments in generative artificial intelligence (GenAI) – e.g., the release of large language models like ChatGPT and Bard – are accelerating the pace of technological change and raising the stakes for the United States and its allies and partners to rapidly organize for sustained competition.



The CCP's Long-Standing Strategy

Since the founding of the PRC in 1949, CCP leaders have continuously emphasized the need to “catch up” to and “surpass” advanced industrial nations in science and technology while holding the goal of “self-reliance” and freedom from external dependence.²

Even as China joined the World Trade Organization (WTO) in 2001 and became deeply integrated into the global economy, the CCP continued to strive for technological self-reliance – often with policies that violated its WTO commitments.³ Decades of engagement from the west and many rounds of dialogue did not persuade the CCP to change course but rather enabled it to pursue its ambitions. Just five years after acceding to the WTO and committing to significant market-oriented reforms, in 2006, the PRC issued the Medium- and Long-Term Plan (MLP) for Science and Technology Development, which called for China to “leapfrog in priority fields,” including telecommunications, integrated circuits, rare earth minerals, and many others.⁴ This was followed in subsequent years by numerous other official plans and strategies designed to put China on a path to “seize the commanding heights” of the fourth industrial revolution.⁵ These included the now-infamous Made in China 2025, an industrial policy issued in 2015 that set explicit targets for global market share in strategic industries and, more recently, the 14th Five-Year Plan for 2021-25, “a one-way decoupling strategy that seeks to increase the world’s dependence on China while reducing China’s dependence on the world for critical technologies.”⁶

All the while, CCP leaders have promoted a highly expansionist conception of national security.⁷ The national strategy of Military-Civil Fusion (MCF), which emerged in the 2010s, seeks to ensure that breakthroughs in civilian research and commercial sectors advance Beijing’s military and economic objectives.⁸ The strategy puts Washington policymakers and

² Chien-Hsun Chen, [Modernization in Mainland China: Self-Reliance and Dependence](#), Journal of Economics and Sociology (1992). See also, Rush Doshi, [The Long Game: China's Grand Strategy to Displace American Order](#), Brookings Institution at 134-156 (2021); Tai Ming Cheung, [Innovate to Dominate: The Rise of the Chinese Techno-Security State](#), Cornell University Press (2022).

³ Stephen Ezell, [False Promises II: The Continuing Gap Between China's WTO Commitments and Its Practices](#), Information Technology and Innovation Foundation (2021)

⁴ [The National Medium- and Long-Term Program for Science and Technology Development \(2006-2020\): An Outline](#), State Council of the People's Republic of China (2006). I address these three in more detail in Part II.

⁵ Rush Doshi, [The United States, China, and the Fourth Industrial Revolution](#), Brookings Institution (2020).

⁶ [Notice of the State Council on the Publication of 'Made in China 2025,'](#) Center for Strategic and Emerging Technology (2022); Matt Pottinger, [Testimony Before the United States-China Economic and Security Review Commission](#) (2021).

⁷ Jude Blanchette, [Ideological Security as National Security](#), Center for Strategic and International Studies at 1 (2020); Samantha Hoffman, [Engineering Global Consent](#), Australian Strategic Policy Institute at 7-8 (2019).

⁸ [Military-Civil Fusion and the People's Republic of China](#), U.S. Department of State (2017-2021).



legislators in the horns of a dilemma because their narrow conceptions of national security are neutered by Beijing's intentional blurring of public and private, military and commercial. Likewise, businesses with exposure to the China market and emerging or sensitive technology-related intellectual property (IP) increasingly find themselves in the crosshairs of MCF, sometimes contributing materially to China's advanced warfighting and surveillance capabilities – whether they know it or not.⁹

Clearly, these efforts are not new, nor are they unique to the tenure of General Secretary Xi Jinping. However, Xi has doubled down on them, emphasizing as early as 2013 the need to “adopt an asymmetrical strategy of catching up and overtaking” rival nations in science and technology.¹⁰ The 14th five-year plan, released in 2021, intensified the drive for self-sufficiency with a policy dubbed “dual circulation.”¹¹ In the same year, Xi stressed that “Technological innovation has become one of the main fields of international strategic competition,” vowing to “resolutely win the battle of key core technologies.”¹² And at the 20th Party Congress in 2022, Xi reinforced these themes, vowing to “achieve greater self-reliance and strength in science and technology.”¹³

A Growing List of Achievements

Comparative assessments are fraught with complexity. Yet it is clear that China is winning a growing number of key technological battles while establishing dominance over supply chains for critical inputs. China leads in 5G network hardware, hypersonic missiles, and commercial drones. It is making significant strides in emerging technologies that in the future will touch all aspects of human life, such as AI, quantum computing, biotechnology, and advanced manufacturing. China dominates the electric vehicle (EV) battery supply chain from end-to-end and sits at the center of critical supply chains for active pharmaceutical ingredients and critical

⁹ Cate Cadell & Ellen Nakashima, [American Technology Boosts China's Hypersonic Missile Program](#), Washington Post (2022); Liza Lin & Josh Chin, [U.S. Tech Companies Prop Up China's Vast Surveillance Network](#), Wall Street Journal (2019).

¹⁰ Chris Buckley & Paul Mozur, [What Keeps Xi Jinping Awake at Night?](#), The New York Times (2018); Julian Baird Gerwitz, [China's Long March to Technological Supremacy](#), Foreign Affairs (2019).

¹¹ [Outline of the People's Republic of China 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035](#), Center for Security and Emerging Technology. Trans. Etcetera Language Group, Inc. (2021).

¹² Xi Jinping, The Governance of China, Volume IV, 224; [\(Authorized Release\) Xi Jinping: Speech at the 20th Academician Conference of the Chinese Academy of Sciences, the 15th Academician Conference of the Chinese Academy of Engineering, and the 10th National Congress of the China Association for Science and Technology](#), Xinhua (2021).

¹³ Xi Jinping, [Report to the 20th National Congress of the Communist Party of China](#), Ministry of Foreign Affairs of the People's Republic of China (2022).



minerals processing.¹⁴ Chinese companies have made significant advances in LiDAR sensor technology, flat panel displays, transport, e-commerce, and mobile payments, and earlier this year, China surpassed Japan to become the world's top auto exporter.¹⁵ Its software platforms, such as TikTok, WeChat, and Shein, have billions of users globally.¹⁶ The notion that China cannot innovate but is “just” the world's workshop – capitalizing on cheap labor to build low-end, low-cost hardware components – is years out of date.¹⁷

Fair and Foul Play

The CCP has cemented its position in key technology sectors by leveraging China's scope and scale. It has used illegitimate and legitimate means, posing an unprecedented challenge for the United States and other democratic market economies. On the illegitimate side, China's achievements are predicated on a particular form of mercantilist economic statecraft, which I describe elsewhere as “brute force economics,” comprised of market access restrictions, massive subsidies, technology transfer requirements for market access, preferential financing, and procurement contracts for domestic firms, intellectual property theft, cyber- and human-enabled espionage, coercion and bullying, forced labor and other poor labor conditions, and other market-distorting policies.¹⁸ These practices have been intermingled with a comprehensive effort to build production capacity in tech-intensive, high-value-added manufacturing industries, resulting in numerous astonishing successes, including many

¹⁴ Kelsi Van Veen & Alex Melton, [Rare Earth Elements Supply Chains, Part 1: An Update on Global Production and Trade](#), U.S. International Trade Commission (2020); [Does China Pose a Threat to Global Rare Earth Supply Chains?](#), China Power, Center for Strategic and International Studies (2021).

¹⁵ For a U.S.-China comparative assessment across multiple critical technologies, see [Harnessing the New Geometry of Innovation](#), Special Competitive Studies Project at 60-92 (2022). On flat panel displays, see Willy Shih, [Supply Chain Disruptions Should Remind Washington to Keep Up with Allies](#), Forbes (2023). On autos, see [China in the Drivers' Seat](#), Special Competitive Studies Project (2023). The 27.5 percent import tariffs on autos from the PRC, dating to the Trump administration, offers the United States some insulation from the coming flood of Chinese cars, as do Inflation Reduction Act tax credits – but it may not be enough. European and Japanese automakers are even more exposed. The United States, EU, and Japan should work together to restrict auto imports from China before the latter can follow its well-established pattern to destroy their domestic industries. See David Ferris & Joshua Posaner, [Miles Apart: The US and EU Diverge on China Car Threat](#), Politico (2023).

¹⁶ Meaghan Waff, [TikTok is the Tip of the Iceberg](#), Special Competitive Studies Project (2023).

¹⁷ China is no longer a low-cost labor country, as wages have significantly increased; labor costs are lower in India, Vietnam, and Mexico. Rosemary Coates, et al., [Global Labor Rate Comparisons: The Impact on Manufacturing Location Decisions and Reshoring](#), Reshoring Institute (2023).

¹⁸ Liza Tobin, [China's Brute Force Economics: Waking up from the Dream of a Level Playing Field](#), Texas National Security Review (2022). On subsidies specifically, Gerard DiPippo, et al. document how PRC subsidies are far out of proportion with those provided in other major economies. See [Red Ink: Estimating Chinese Industrial Policy Spending in Comparative Perspective](#), Center for Strategic and International Studies (2021).



process innovations.¹⁹ All this has occurred against the backdrop of decades of U.S. policy failures, blind faith in free markets and globalization, and strategic neglect of the production end of the value chain, leaving us vulnerable.

Undermining Innovation

It may be reasonably asked, why is it a problem that China exports subsidized products to advanced economies like the United States? This arrangement would seemingly allow us to benefit from both lower labor costs in China and the largesse of PRC industrial strategy. This might be true if the PRC's industrial policies were static, focused only on the upstream end of key supply chains – but this is not the case. The PRC intentionally creates overcapacity and sells products at below-market rates in order to gain market share and move up the value chain. In the process, it displaces American firms, decimating entire industries and stifling innovation. China has undermined innovation globally by decreasing incentives for new and disruptive market entrants.²⁰ A prime example is the solar panel industry. The technology was first invented and commercialized in the United States, but China's brute force economics has not only pushed American and European firms out of the industry but suppressed innovation in the sector.²¹

Ultimately, Beijing's tactics serve the ends of its broader political strategy, which aims to transform the international environment in a manner compatible with China's governance model and facilitate its emergence as a global leader.²² This strategy aims to weaken U.S. alliances which Beijing sees as a key constraint on its ambitions.²³ As its economic power has grown, Beijing has increasingly turned to threats of economic coercion. However, as the threats have proliferated, so have examples of countries that have successfully resisted and instead chosen sovereignty, resilience, and diversification.²⁴ As when dealing with a bully, the prudent

¹⁹ Dan Wang, [China's Hidden Tech Revolution: How Beijing Threatens U.S. Dominance](#), Foreign Affairs (2023).

²⁰ Ian Clay & Robert D. Atkinson, [Wake Up, America: China is Overtaking the United States in Innovation Capacity](#), Information Technology and Innovation Foundation (2023); Robert D. Atkinson, [How China's Mercantilist Policies Have Undermined Global Innovation in the Telecom Equipment Industry](#), Information Technology and Innovation Foundation (2020).

²¹ David M. Hart, [The Impact of China's Production Surge on Innovation in the Global Solar Voltaics Industry](#), Information Technology & Innovation Foundation (2020); Rick Switzer & David Feith, [China Hit Some Bumps on Its Road to Semiconductor Dominance](#), Wall Street Journal (2022).

²² Daniel Tobin, [Testimony before the U.S.-China Economic and Security Review Commission](#) (2020).

²³ Liza Tobin, [Xi's Vision for Transforming Global Governance: A Strategic Challenge for Washington and its Allies](#), Texas National Security Review (2018); see also Rush Doshi, [The Long Game: China's Grand Strategy to Displace American Order](#), Brookings Institution at 134-156 (2021).

²⁴ Many countries have resisted PRC economic coercion while remaining under the radar, since quiet resistance is less likely to provoke a backlash from Beijing. Well-known examples of countries that have successfully withstood PRC economic coercion include Japan, Australia, Lithuania, and Sweden. For



response to Beijing's threats is not to give in (which reinforces bad behavior) but to resist (often quietly), team up with friends, and, crucially, reduce economic exposure. Diversification takes time. It will not be easy or free. But momentum is growing among the world's democratic market economies toward "de-risking." With the largest – the United States, the European Union, and Japan – leading the pack, others will follow.²⁵

China is experiencing a structural economic slowdown that is most likely irreversible.²⁶ While this will accelerate geopolitical trends toward de-risking, it does not give us room for complacency in the technology competition. Even at much lower GDP growth rates, China will continue to finance its techno-industrial and military priorities. Spending relatively less on China's social safety net is a tradeoff the CCP has always been willing to make.

U.S. Asymmetric Advantages

The United States and its allies and partners have many reasons for confidence. America brings many fundamental, asymmetric advantages to techno-economic competition. The most recent and dramatic example is American innovation at the technological frontier in AI. This general purpose technology could catalyze a fourth industrial revolution and unleash tremendous productivity growth. AI, and in particular generative AI, carries many risks but also has the potential to redound decisively to the geostrategic advantage of the United States and other democracies if harnessed wisely.²⁷ Additional advantages include world-leading academic research institutions and companies, as well as its status as the top global destination for talent. In terms of finance, the United States is unrivaled: the dollar is the global reserve currency, and our equity markets are the largest, deepest, and most liquid in the world, nearly quadrupling the value of China's.²⁸ While China is admittedly the world's top trading

instance, after China threatened to cut off rare earth supplies to Japan in 2010, Japan wisely undertook efforts to diversify away from China and now is a leader on economic security efforts. See David Adler, [‘Economic Security’ Became Magic Words in Japan](#), Foreign Policy (2023). The European Union is also emphasizing the need to diversify supply chains away from China. See [Speech by President von der Leyen on EU-China Relations at the Mercator Institute for China Studies and the European Policy Centre](#), European Commission (2023).

²⁵ For SCSP recommendations on friendshoring, see Liza Tobin, Warren Wilson, Brady Helwig, and Connor Martin, [A DemTech Economic Agenda: Ten Steps Toward Collective Resilience](#), Noahpinion (2023).

²⁶ Daniel H. Rosen, [The Age of Slow Growth in China](#), Foreign Affairs (2022).

²⁷ SCSP has a forthcoming report with policy recommendations on generative AI.

²⁸ For more on these advantages, along with citations, see [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 4-8 (2022). Some readers may challenge these points by noting, e.g., severe problems with the U.S. immigration system, China's attempts to displace the dollar as the global reserve currency, etc. For SCSP's recommendations on these topics, see Chapter III (People) and IV (Project) in the same report. U.S. equity markets are the largest in the world, representing 41.1% of the \$107 trillion global equity market cap in 2023, or \$44 trillion. This is 3.6x the next largest market, China, with 11.6%. See [Research Quarterly: Equities](#), Securities Industry and Financial Markets Association (2023).

nation, the United States leads in investment: our foreign direct investment, which powers global growth and reinforces the alignment of our commercial and strategic interests with allies and partners, significantly outstrips China's.²⁹

The aforementioned facts are specific to the United States, but when combined with the markets, talent pools, research and development (R&D) spending, and other resources of our allies and partners, the picture becomes even brighter. The implications are clear: we must *pool* our advantages to prevail in sustained techno-economic competition. Domestically, this means harnessing the public-private engine of innovation.³⁰ Internationally, it means increasing market linkages with our allies and partners while reducing them with China, particularly where excessive exposure to China puts our national security and competitiveness at risk. When combined, democracies account for more than 60 percent of global GDP.³¹ The United States alone is a more significant source of *accessible* market demand than China – which, despite its large consumer base, is a smaller source of market demand for foreign firms than its sheer size would suggest since it partially or wholly restricts large portions of the PRC market to foreign competition.³²

II. Filling the Gaps in the “Promote and Protect” Framework

To prevail in the techno-economic competition, the United States must ensure that three key elements are present in its strategic approach: *promoting* U.S. and allied and partner technology strength, *protecting* our advantages from PRC exploitation, and *pooling* market demand among allies and partners.

Consensus is already growing in Washington on the first two elements, although additional policy options and robust implementation of existing policies are still needed. My colleagues and I at SCSP have published numerous proposals related to these elements on topics ranging from data governance and immigration reform to industrial strategy and export controls, to automation's impact on the workforce, to how the U.S. Government should develop technology strategy with the private sector. We have also published proposals for how to strengthen ties

²⁹ As my friend and mentor Matt Pottinger once said, “Trade is dating but investment is marriage.” For a comparison of U.S. v. PRC foreign direct investment, see [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 6 (2022).

³⁰ SCSP is seeking to model a public-private process for national techno-economic strategy and engage with allies and partners to identify areas of synergy and collaboration. An output of the public-private process is the action plans listed at the end of this testimony.

³¹ Tom Orlik, et al., [A Third of Global GDP Now Generated in Non-Democracies](#), Bloomberg (2022).

³² Agatha Kratz and Janka Oertel show how a lack of reciprocal market access is harming European firms. They note that “waiting for China to ‘normalise’ its behavior and open up is a risky choice.” Agatha Kratz & Janka Oertel, [Home Advantage: How China's Protected Markets Threatens Europe's Economic Power](#), Rhodium (2021).



with our allies and partners. *Many of these publications are listed in the “for further reading” section at the end of this testimony.* I will not repeat them here, but I urge the Committee and its staff to read them and advance those within your purview.

The Importance of Demand

The third element, pooling market demand, has been severely underutilized, but it is crucial to pushing back against Beijing’s predatory industrial policies. As such, it merits much more targeted attention from policymakers and legislators. Without the development of robust “pooling” policies, “promote” and “protect” measures will see their effectiveness wane over time as they are exposed to China’s brute force economics. This will be true as long as we face a techno-economic rival willing to manipulate global markets and turn the idea of a “level playing field” into a farce. Put another way, “protect” measures like export controls are defensive, and they only work when there is a technology advantage to protect – not once China has surpassed us in a particular technology. “Promote” measures amount to “running faster,” which is essential but insufficient on its own, since our rival has been running faster for decades – it started very far behind us but is finally catching up and in some areas getting ahead. “Pooling” involves creating a new playing field with our friends and excluding the lead cheater.

The CCP’s brute force economics replaces the world imagined by Ricardian theorists (where countries trade based on comparative advantage, increasing total welfare) with a new economic order where global demand is increasingly “pooled” within China.³³ Market demand – the source of revenue that companies and entire economies need to survive, grow, and reinvest in the future – becomes less and less available for others. Xi offered a glimpse of the PRC’s plans to leverage its sectoral dominance, remarking in 2020 that China “must tighten international production chains’ dependence on China, forming a powerful countermeasure and deterrent capability against foreigners who would artificially cut off supply.”³⁴

Our goal should be to build markets that are unencumbered by Beijing’s market-distorting practices and much less reliant on PRC producers. The focus should be on critical products

³³ I recognize that it is impossible for any single country to dominate all value chains, and China is no exception. It is an important source of demand to many countries, e.g. intermediate goods from Southeast Asia and commodities from numerous countries around the world, including the United States. But particularly for advanced economies, market access is highly non-reciprocal and Beijing is ruthless in displacing foreign competitors in order to move up the value chain and control critical technologies.

³⁴ Xi Jinping, [Certain Major Issues for Our National Medium- to Long-Term Economic and Social Development Strategy](#), Qiushi, translated by the Center for Security and Emerging Technology (2020); Gregory C. Allen, [China’s New Strategy For Waging the Microchip Tech War](#), Center for Strategic and International Studies at 5 (2023); Henry Farrel & Abraham L. Newman, [Weaponized Interdependence: How Global Economic Networks Shape State Coercion](#), International Security (2019).

and services.³⁵ In these new markets, American firms and those in allied and partner countries will have access to sufficient demand to thrive and compete on a genuine level playing field. At the international level, this would entail forming “demand alliances” focused on specific critical technologies or inputs. These alliances, either formal or informal, would restrict market access to China while increasing cross-border transactions among like-minded participants. At the domestic level, America can leverage its large market to accomplish similar goals, directing demand away from China and toward U.S. firms. This approach is based on reciprocity: the PRC constantly manipulates its market as a tool of statecraft. Persuading it to change through dialogue is futile.³⁶ The only way the United States and its allies and partners can experience a level playing field is by cutting out the bad actor.³⁷ Blocking the PRC is not the same as emulating the CCP’s drive for self-reliance. Instead, it is a shift toward less interdependence with an adversary and more with friends.

Policy Options

Policies that can move us in this direction include trade agreements and punitive measures (e.g., tariffs and countervailing duties) designed to reduce barriers to trade with allies and partners while increasing them with China. Other policies that can mitigate bilateral exposure in strategic sectors include import restrictions, labeling requirements, security certifications for critical infrastructure components, the use of government procurement to target demand, and country-of-origin requirements. This is not a comprehensive list of potential policies but rather a starting place that would benefit from further attention from the policy community. Advantageous avenues for analysis include exploring the legal and political feasibility of proposals, determining where Congress needs to establish new authorities or change existing

³⁵ Pooling efforts should be focused on critical technologies and advanced industries where dependence on China is a strategic and economic vulnerability. As Robert D. Atkinson notes, U.S. trade policy should recognize that computer chips and potato chips are not of equal importance for national competitiveness. Robert D. Atkinson, [Potato Chips, Computer Chips: Yes, There Is a Difference](#), American Compass (2020). In a forthcoming article which Atkinson gave me permission to cite, he lays out a framework for making these distinctions, arguing for trade policy focused on high fixed cost industries that tend to be technology-intensive (semiconductors, computers, and communications equipment are examples). See Robert D. Atkinson, *A New Approach to U.S. Trade Policy in the Global Battle Over Advanced Industries*, The International Economy (forthcoming in 2023).

³⁶ The United States tried – and failed – for many years to persuade China to change its practices through dialogue, i.e. the Strategic and Economic Dialogue and others. Europeans have also tried many times and failed. The German phrase *Wandel durch Handel*, “change through trade,” captures a similar, failed policy approach to China.

³⁷ For an analysis of how strategic competition could shape the global international economic order, see Aaron L. Friedberg, [The Growing Rivalry Between America and China and the Future of Globalization](#), Texas National Security Review (2021/22).

laws, and assessments of how U.S. tools can be used in complementary ways with allies and partners.³⁸

Given the current skepticism in Washington toward international trade, special attention is needed to demonstrate how increased trade with allies and partners – and less with China – can benefit Americans. For the nation’s long-term economic prosperity and strategic competitiveness, both sides of the aisle must come together to overcome opposition to new trade agreements involving market access.

This three-pillar framework – *protecting*, *promoting*, and *pooling* market demand among market-oriented, rule-of-law economies – can be applied to promote resilience among the United States and its allies and partners across key strategic sectors. Depending on the sector, one of these “P’s” may be more crucial than the others.³⁹ I will use three examples to explain this framework: microelectronics, critical minerals and rare earths, and advanced networks.⁴⁰ I chose these three because of their relevance for national security and competitiveness and because SCSP has written about all three.⁴¹ This protect, promote, and pooling framework will look different when applied to other technologies, such as biotechnology.⁴²

1. Microelectronics

Chips are at the heart of the technology competition with the PRC. Semiconductors are China’s most significant import, totaling over \$400 billion in 2022.⁴³ As such, building a globally

³⁸ A paper that offers a concrete proposal on how to reform Section 337 of the U.S. International Trade Commission’s statute to empower it to bar imports of the PRC products that have benefited from its brute force economic tactics is Robert D. Atkinson, [How to Mitigate the Damages from China’s Unfair Trade Practices by Giving USITC Power to Make Them Less Profitable](#), Information Technology & Innovation Foundation (2022).

³⁹ Export controls, for instance – a key “protect” tool – have little value when there is not a “chokepoint” technology.

⁴⁰ Of note, all three were mentioned in [China’s Medium- and Long-Term Plan for Science and Technology Development](#) issued in 2006 and discussed earlier in this testimony. The plan notes, for instance, “Microelectronics-based information technology will soon reach its limit . . . mankind has to find a new way out,” foreshadowing the current race to develop new computing paradigms and calling for China to prioritize quantum technology, “a new competition target among developed nations.”

⁴¹ [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 19-22; 27-40 (2022); [National Action Plan for U.S. Advantage in Advanced Networks](#), Special Competitive Studies Project (2023).

⁴² The United States maintains leadership in biotechnology, although China is making concerted efforts to catch up. Numerous “promote” proposals are contained in the [National Action Plan for U.S. Leadership in Biotechnology](#), Special Competitive Studies Project (2023). For “protect” and “pooling” proposals, see 17-20.

⁴³ Lilian Zhang, [China’s Chip Imports Plunge in 2022 Amid Zero-Covid Supply Chain Disruption and US Trade Restrictions on the Sector](#), South China Morning Post (2023); Christopher A. Thomas, [Lagging But Motivated: The State of China’s Semiconductor Industry](#), Brookings Institution (2021).



competitive microelectronics industry has long been a priority for Beijing, with at least \$150 billion in government support committed to date.⁴⁴ While the conventional narrative is that these policies have been a failure, China has achieved significant victories across several verticals: YMTC and CXMT, national champions established under the 2014 National IC Plan, now occupy significant positions in the memory chip market.⁴⁵ Biren, an AI chip design startup founded in 2019, developed a Graphics Processing Unit (GPU) roughly on par with Nvidia's offerings in terms of performance before its efforts were hampered by the October 7 export controls.⁴⁶ National champion JCET lags behind only TSMC in market share and technological leadership for advanced packaging.⁴⁷

- **Protect:** Efforts to protect the United States and allied technological advantages in semiconductors, particularly through export controls, are well underway and must continue. Export controls are not a static policy tool that can be expected to solve a particular problem once and for all. Rather, they require continuous monitoring and updating as new information becomes available and technology and adversaries' tactics evolve. The Department of Commerce has issued export controls on high-end AI chips and semiconductor manufacturing equipment, and Japan and the Netherlands have taken complementary measures.⁴⁸ But to achieve success, additional steps are needed to close gaps that China has exploited since the interim rules were issued on October 7, 2022.⁴⁹ Commerce should tighten the restrictions without delay and also implement know-your-customer (KYC) requirements for U.S. cloud providers – as required by Executive Order 13984. The Department of State should support KYC

⁴⁴ Stephen Ezell, [Moore's Law Under Attack: The Impact of China's Policies on Global Semiconductor Innovation](#), Information Technology & Innovation Foundation (2021); Karen M. Sutter, [China's New Semiconductor Policies: Issues for Congress](#), Congressional Research Service (2021).

⁴⁵ Jeongdong Choe, [YMTC 232L Xtacking3.0: Now, YMTC is a Leading Pioneer in 3D NAND](#), TechInsights (2023). YMTC and CXMT represent two of the three national champions identified and funded by the PRC government under Beijing's 2014 National IC Plan. See Stephen Ezell, [Moore's Law Under Attack: The Impact of China's Policies on Global Semiconductor Innovation](#), Information Technology & Innovation Foundation (2021); [Project 506: CXMT and China's Semiconductor Industrial Policy](#), Horizon Advisory (2022); Dan Kim & John VerWey, [The Potential Impacts of the Made in China 2025 Roadmap on the Integrated Circuit Industries in the U.S., EU and Japan](#), Office of Industries, U.S. International Trade Commission (2019).

⁴⁶ Mike Hong & Lingjie Xu, [壁仞™ BR100 GPGPU: Accelerating Datacenter Scale AI Computing](#), IEEE (2022).

⁴⁷ See [Harnessing the New Geometry of Innovation](#), Special Competitive Studies Project at 83-87 (2022); Dan Armbrust, et al., [America's Lead in Advanced Computing Is Almost Gone](#), Georgetown Public Policy Review (2023); [JCET Will Continuously Focus on R&D and Resource Investment, Preparing for Future Market Growth](#), Cision (2023).

⁴⁸ Yuka Hayashi & Vivian Salama, [Japan, Netherlands Agree to Limit Export of Chipmaking Equipment to China](#), Wall Street Journal (2023)

⁴⁹ Demetri Sevastopulo, [US Weighs Tighter Restrictions on AI Chips Exports to China](#), Financial Times (2023); Eleanor Olcott, et al, [Chinese AI Groups Use Cloud Services to Evade US Chip Export Controls](#), Financial Times (2023).



requirements abroad through diplomatic outreach.⁵⁰ Commerce's Bureau of Industry and Security should also be given sufficient resources and tools for robust monitoring and enforcement of the controls.

- **Promote:** The CHIPS and Science Act represents a significant first step to rebuilding U.S. semiconductor manufacturing capacity and investing in research and development. However, work remains to be done to ensure the United States retains technological leadership in the intermediate and long term. CHIPS R&D programs must be calibrated to ensure U.S. leadership during the intermediate-term transition to building chips in 3D via heterogeneous integration while also providing adequate resources and nurturing communities of engineering practice to scale emerging post-CMOS paradigms.⁵¹
- **Pool:** While protect and promote measures are well underway for chips, a concerted effort is sorely needed to pool market demand *before* China can use brute force economics to undercut the competition and flood the market with inexpensive, insecure chips. In the wake of the October 7, 2022 controls, Beijing has redoubled its efforts to build out production capacity at lagging-edge nodes.⁵² Over the next five years, China is projected to add nearly as much capacity at the lagging-edge as the rest of the world combined.⁵³ These chips are critical to our daily lives, powering everything from defense systems and robotics to automobiles and consumer applications. Because they are lagging-edge, export controls are not the relevant tool. The United States must work with allies and partners to pool their market demand by restricting imports from China and blocking their deployment in critical infrastructure.⁵⁴

2. Critical Minerals and Rare Earths

⁵⁰ [Executive Order on Taking Additional Steps to Address the National Emergency with Respect to Significant Malicious Cyber-Enabled Activities](#), The White House (2021); Tim Fist, et al., [Chinese Firms Are Evading Chip Controls](#), Foreign Policy (2023).

⁵¹ Complementary metal-oxide-semiconductor (CMOS) is currently the technology used in most integrated circuits. This fall, SCSP will publish a National Action Plan for Microelectronics containing detailed proposals for ensuring U.S. technological leadership in novel and emerging paradigms.

⁵² Jane Lee, et al., [Analysis: China's Massive Older Chip Tech Buildup Raises U.S. Concern](#), Reuters (2022).

⁵³ Jan-Peter Kleinhans, et al., [Running on Ice: China's Chipmakers in a Post-October 7 World](#), Rhodium Group (2023).

⁵⁴ Additional proposals will be contained in SCSP's forthcoming microelectronics action plan. On the issue of open source hardware, see Rick Switzer, [The Next Pandemic Could Be Digital: Open Source Hardware and New Vectors of National Cybersecurity Risk](#), Special Competitive Studies Project (2023).



China enjoys broad sectoral dominance across the value chain for critical minerals, with near monopolies on access to key inputs (especially heavy rare earths) necessary for most techno-industrial activities. The PRC also enjoys technological and market leadership in processing and refinement capabilities for rare earths.⁵⁵ In recent years, Beijing has accelerated efforts to cement its position across key nodes in strategic minerals supply chains, creating dependencies that provide geopolitical leverage.⁵⁶ Given this state of affairs, the U.S. government and its allies and partners must find ways to offset the PRC's dominance in minerals processing.⁵⁷

- **Protect:** America must accelerate efforts to ensure a sufficient supply of rare earths and other critical minerals in the event of a conflict, with the Department of Defense taking a leading role in stockpiling strategic resources. The U.S. government should also curb imports of critical minerals mined and processed by PRC companies, in particular, for U.S. defense platforms.⁵⁸
- **Promote:** The U.S. government should continue to leverage the Defense Production Act to boost domestic capacity, though additional support – such as tax credits and subsidies – may be necessary. Ultimately, the United States needs to open many more domestic mines, but this will require meaningful permitting reform and policymakers' green light to conduct mapping, exploration, and feasibility studies. In the intermediate and long term, the Department of Energy should continue to fund and explore alternative production and sourcing methods, such as extracting minerals from coal tailings and even biomanufacturing.⁵⁹
- **Pool:** To accelerate friendshoring in critical mineral supply chains, the United States should bolster its foreign policy and trade instruments. The critical minerals trade agreement signed in March with Japan is a promising recent move that should be replicated elsewhere. The agreement allows Japanese companies to benefit from Inflation Reduction Act incentives while the United States benefits from Japan's critical

⁵⁵ Kristin Vekasi, [Testimony at Hearing on U.S.-China Competition in Global Supply Chains](#), United States-China Economic and Security Review Commission (2022).

⁵⁶ See [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 19 (2022).

⁵⁷ The best paper on this topic is Emily de la Bruyère & Nathan Picarsic, [Elemental Strategy: Countering the Chinese Communist Party's Efforts to Dominate the Rare Earths Industry](#), Foundation for Defense of Democracies (2022). For more details and sources for this section, see [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 19-21 (2022).

⁵⁸ [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 19-22 (2022).

⁵⁹ [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 19-22 (2022).



minerals processing and production capabilities.⁶⁰ Additional steps should include scaling and expanding the scope of the State Department’s Minerals Security Partnership, directing the U.S. International Development Finance Corporation and other agencies to invest in mining and processing facilities in partner countries, and further developing the Critical Minerals Club.⁶¹

3. Advanced Networks (5G, 6G, and More)

Leadership in advanced networks — the critical backbone for telecommunications and emerging technologies like AI and robotics — is essential for national competitiveness. The United States was caught flatfooted several years ago by the dominance of PRC national champions Huawei and ZTE in this sector. This necessitated a years-long campaign to persuade allies and partners not to use components from these firms for their 5G network infrastructure. The United States, “with a telecommunications manufacturing industry weakened by years of poor management and policy neglect, failed to offer end-to-end alternatives to countries it sought to warn away from” untrustworthy PRC firms.⁶² Advanced networks are much more than 5G network hardware, however, and there are steps that the United States and its allies and partners can take to regain the advantage.

- **Protect:** The Federal Communication Commission’s (FCC) bans on equipment from Huawei, ZTE, and other untrustworthy firms were important steps,⁶³ but Congress must ensure that the FCC’s “Rip and Replace” program to replace untrusted equipment is fully funded. Failure to do so “will leave U.S. carriers in a weaker financial position and even less able to invest in new, innovative infrastructure”⁶⁴ while also undercutting U.S. attempts to persuade allies and partners to abandon these untrustworthy firms. SCSP has also recommended further “protect” actions, including export controls or licensing

⁶⁰ [United States and Japan Sign Critical Minerals Agreement](#), Office of the United States Trade Representative (2023). The agreement also commits the two countries to cooperate on discouraging the import of goods containing critical minerals that involve forced labor. [U.S.-Japan Critical Minerals Agreement](#), Congressional Research Service (2023).

⁶¹ [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 19-22 (2022).

⁶² Jon Pelson & Warren Wilson, [Round Two of the 5G Battle is Just Beginning. Can America Surge Ahead?](#), Special Competitive Studies Project (2023).

⁶³ Likewise, FCC revoked the licenses of PRC telecom service providers such as China Unicom and China Telecom.

⁶⁴ [National Action Plan for U.S. Advantage in Advanced Networks](#), Special Competitive Studies Project (2023) at 10. FCC concluded that an additional \$3.7 billion is needed. See [Secure and Trusted Communications Networks Reimbursement Program Report](#), U.S. Federal Communications Commission (2023).



policy changes for Huawei and ZTE as well as chip manufacturer SMIC.⁶⁵ The United States should also restrict PRC cloud companies from operating in the United States.

- **Promote:** U.S. leaders must think beyond the recent policy focus on 5G network hardware and adopt a “full stack approach” to competing overseas in digital infrastructure. This means capitalizing on parts of the network technology stack where the United States has advantages and leaning on allies and partners in other areas. U.S. strengths include low-earth orbit (LEO) satellites, data centers, cloud computing, and potential leapfrog technologies, like free space optical communications and networks (FSONs). The United States should also work with allies and partners to guide the development of 6G and other standards-setting processes.
- **Pool:** The United States and its key allies and partners should develop new network supply chains free of network components produced in China – or by PRC-owned vendors. As the U.S. government prioritizes Open RAN, it should ensure that the transition to open network architecture addresses new security vulnerabilities from the start and does not create new dependencies on China for insecure, open source components.⁶⁶

For Further Reading:

To achieve this competitive framework, I submit for your review and consideration the following resources to advise and assist the Committee in its critical work:

- Mid-Decade Challenges to National Competitiveness, Special Competitive Studies Project (2022) at Chapter 2 and Chapter 7;
- Restoring the Sources of Techno-Economic Advantage, Special Competitive Studies Project (2022);
- Harnessing the New Geometry of Innovation, Special Competitive Studies Project (2022);
- National Data Action Plan, Special Competitive Studies Project (2022);

⁶⁵ [Restoring the Sources of Techno-Economic Advantage](#), Special Competitive Studies Project at 74-75 (2022).

⁶⁶ For the proposals in this section, additional details can be found in the [National Action Plan for U.S. Advantage in Advanced Networks](#), Special Competitive Studies Project at 9-11; 15-18 (2023). For more on open source hardware risks and how to mitigate them, see Rick Switzer, [The Next Pandemic Could Be Digital: Open Source Hardware and New Vectors of National Cybersecurity Risk](#), Special Competitive Studies Project (2023), or a condensed version [here](#).



- Defending Digital Freedom and the Competition for the Future of the Global Order, Special Competitive Studies Project (2022);
- National Action Plan for U.S. Leadership in Biotechnology, Special Competitive Studies Project (2023);
- National Action Plan for U.S. Leadership in Advanced Networks, Special Competitive Studies Project (2023);
- Automation Across Industries, Special Competitive Studies Project (2023);
- A DemTech Economic Agenda: Ten Steps Toward Economic Resilience, Noahpinion (2023);
- Crossing the Digital Atlantic: A U.S.-EU Agenda for the Age of AI, Special Competitive Studies Project (2023);
- Eric Schmidt, To Compete With China on Tech, America Needs to Fix Its Immigration System, Foreign Affairs (2023);
- Robert D. Atkinson, How to Mitigate the Damage From China's Unfair Trade Practices by Giving USITC Power to Make Them Less Profitable, Information Technology and Innovation Foundation (2022); and
- Aaron L. Friedberg, The Growing Rivalry Between America and China and the Future of Globalization, Texas National Security Review (2021/22).

Thank you again for the opportunity to submit testimony to your committee on this important topic. Please don't hesitate to contact me if you have any questions or would like additional information.

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